

## A new record and a new species of *Stegopterna* (Diptera: Simuliidae) in Honshu, Japan

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**Abstract:** Two black-fly species belonging to the genus *Stegopterna*, *St. trigonium* (Lundström) and *St. takeshii* sp. nov., are described based on the reared adults, pupae, and mature larvae collected from Tochigi Prefecture in Honshu, Japan. *Stegopterna trigonium*, widely distributed in the Holarctic Region, is recorded for the first time from Japan. *Stegopterna takeshii* sp. nov. is characterized by the 12 pupal gill filaments arranged in two groups (seven filaments in the dorsal group, and five filaments in the ventral group).

Key words: black fly, *Stegopterna*, Simuliidae, Japan, new species

Bentinck (1955) reported *Stegopterna mutata* (Malloch) based on female adults captured while biting a human in Akita, Ishikawa, Nagano and Yamanashi Prefectures in Honshu, Japan. Ono (1977) pointed out that what had been called *St. mutata* in Honshu was not *St. mutata*, originally described from North America, and that it also differs from *St. nukabirana* Ono, which he described as a new species from Hokkaido, northern Japan. No further studies were carried out on the species of *Stegopterna* in Honshu.

I had an opportunity to examine a few adults emerged from pupae, many pupae, and mature larvae of the genus *Stegopterna* collected in Tochigi Prefecture, Honshu, in 1982 and 1985, by Dr. T. Matsu-mura, and found that there are two species of *Stegopterna*, both of which differ from *St. nukabirana*. One is *St. trigonium* (Lundström), widely distributed in Eurasia (Crosskey and Howard, 1997) and North America (Adler et al., 2004), and the other is a new species, which is here described.

The terms of morphological features used here follow those of Takaoka (2003).

Holotype and paratype specimens of the new species will be deposited at the Department of Infectious Disease Control, Faculty of Medicine, Oita University, Oita, Japan.

***Stegopterna trigonium* (Lundström, 1911)**  
*Melusina trigonium* Lundström 1911: 18–19.

*Cnetha Freyi* [sic] Enderlein 1929: 73–74.  
*Stegopterna Richteri* [sic] Enderlein 1930: 90.

*Stegopterna richteri majalis* Rubtsov and Carlsson 1965: 12–15.

*Stegopterna richteri dentata* Rubtsov and Carlsson 1965: 15–17.

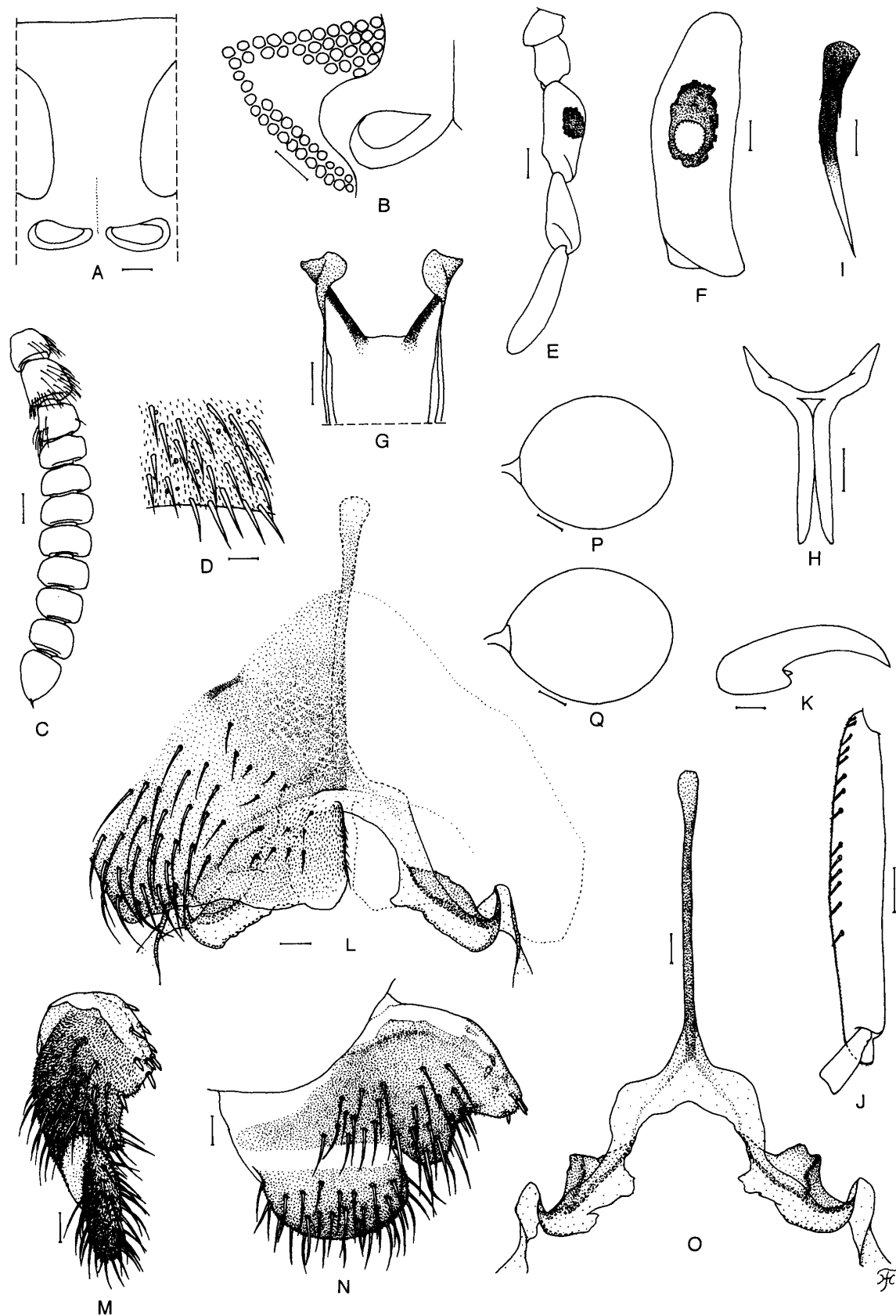
*Stegopterna richteri haematophaga* Rubtsov and Carlsson 1965: 17.

*Stegopterna richteri longicoxa* Rubtsov 1971: 172–174.

**DESCRIPTION. Female.** Body length 3.4 mm. **Head.** Narrower than width of thorax. Frons medium brown, thinly white pruinose, slightly shiny at certain angle of light, and densely covered with whitish-yellow recumbent fine hairs and also with several dark stout hairs along lateral margins; frons (Fig. 1A)

somewhat narrowed toward antennal bases; ratio of narrowest portion of frons and widest portion of head 1.0 : 5.5-5.7. Fronto-ocular area (Fig. 1B) well developed, triangular, directed

laterally and somewhat upwards. Clypeus medium brown, thinly white pruinose, slightly shiny at certain angle of light, densely covered with whitish-yellow recumbent fine hairs inter-



mixed with many dark stout hairs along lateral and lower margins. Labrum 0.67–0.73 times as long as clypeus. Antenna (Fig. 1C) composed of 2+9 segments, medium to dark brown except scape and pedicel light brown; scape and pedicel covered with many medium-long hairs usually on anterior surface, and 1st flagellar segment with similar medium-long hairs on posterior surface; all flagellar segments (Fig. 1D) densely covered with short setae as well as microsetae. Maxillary palp (Fig. 1E) light to medium brown, with 5 segments, proportional lengths of 3rd, 4th, and 5th segments 1.00 : 0.80–0.86 : 1.16–1.30; 3rd segment (Fig. 1F) not enlarged; sensory vesicle ellipsoidal, with rugged surface, 0.32–0.35 times length of 3rd segment, with medium to large round opening medially or apically. Maxillary lacinia with 9 inner and 17 or 18 outer teeth. Mandible with 27–29 inner and 14 outer teeth. Cibarium (Fig. 1G) smooth, with dorsal margin deeply concave and strongly sclerotized on each side. **Thorax.** Scutum medium to dark brown, thinly white pruinose, slightly shiny at certain angle of light, densely covered with whitish-yellow recumbent fine hairs interspersed with dark long upright hairs on prescutellar area. Scutellum medium to dark brown, slightly shiny at certain angle of light, with dark long hairs as well as whitish-yellow short hairs. Postnotum medium brown, thinly white pruinose, slightly shiny at certain angle of light, and bare. Pleural membrane bare. Katepisternum longer than deep, and bare. Furcasternum (Fig. 1H) without ventrally directed apodemes on internal dorsal arms. **Legs.** All medium brown; fore basitarsus slender, cylindrical; hind tibial spurs (Fig. 1I) long, each with hyaline apex; hind basitarsus (Fig. 1J) nearly parallel-sided, 6.1 times as long as wide, 0.83 and 0.63 times as wide as greatest widths of hind tibia and femur, respectively; calcipala short, nearly as long as its basal width and 0.53 times as wide as greatest width of basitarsus; pedisulcus very shallow; tarsal claws (Fig. 1K) each with

minute unpigmented tooth. **Wing.** Length 3.0 mm; costa with dark brown spinules and medium brown hairs; subcosta fully haired ventrally; basal section of vein R fully haired dorsally, 0.33 times as long as the remaining distance to wing apex; R<sub>1</sub> with medium brown hairs dorsally (though a few dark spinules present near apex in 1 female); R<sub>2</sub> with medium brown hairs ventrally; radial sector unforked; hair tuft at base of stem vein medium brown; basal medial cell present. **Abdomen.** Basal scale medium to dark brown, with fringe of pale hairs; abdominal segments light brown except tergites medium brown, moderately covered with whitish-yellow short hairs as well as dark longer hairs; tergites 5–8 slightly shiny at certain angle of light. **Genitalia.** Ventral surface of abdominal segment 7 with large sternal plate medially. Sternite 8 (Fig. 1L) extending in middle anteriorly, with pair of strongly sclerotized dark bands submedially along anterior margin, bare medially, and with 18–37 dark short to long hairs laterally on each side; ovipositor valves (Fig. 1L) triangular in shape, membranous, each covered with 9–14 short hairs as well as numerous microsetae except narrow portion along posterior margin bare and transparent; inner borders moderately sclerotized, somewhat concave medially, and narrowly separated from each other. Genital fork (Fig. 1O) of inverted-Y form, with well sclerotized stem; arms thin and rather broad, each with broad well-sclerotized apodeme arising anterodorsally from its lateral plate, which is broad, thin, somewhat produced inwardly at its inner corner, and strongly curved dorsally near its apex. Paraproct in ventral view (Fig. 1M) widely bare along anterior and anteromedial margins, and with 7–10 short stout spines on its bare surface of anteromedial margin; paraproct in lateral view (Fig. 1N) much protruding ventrally, about twice as wide as cercus, covered with 15–33 stout hairs laterally and ventrally. Cercus (Fig. 1N) rounded posteriorly, about half as long as wide,

Fig. 1. Morphological characters of female of *Stegopterna trigonium*. A, frons; B, fronto-ocular area; C, antenna; D, enlargement of surface of 2nd flagellar segment of antenna; E, maxillary palp (outer view); F, 3rd segment of maxillary palp (front view); G, cibarium; H, furcasternum; I, tibial spur of hind leg; J, basitarsus and 2nd tarsal segment of hind leg; K, claw; L, 8th sternite, ovipositor valves and genital fork *in situ* (ventral view); M, paraproct and cercus (ventral view); N, paraproct and cercus (outer view); O, genital fork; P and Q, spermathecae (P, globular; Q, somewhat ellipsoidal). Scale bars. 0.1 mm for H and J; 0.05 mm for A–C, E and G; 0.02 mm for F, I and L–Q; 0.01 mm for D and K.

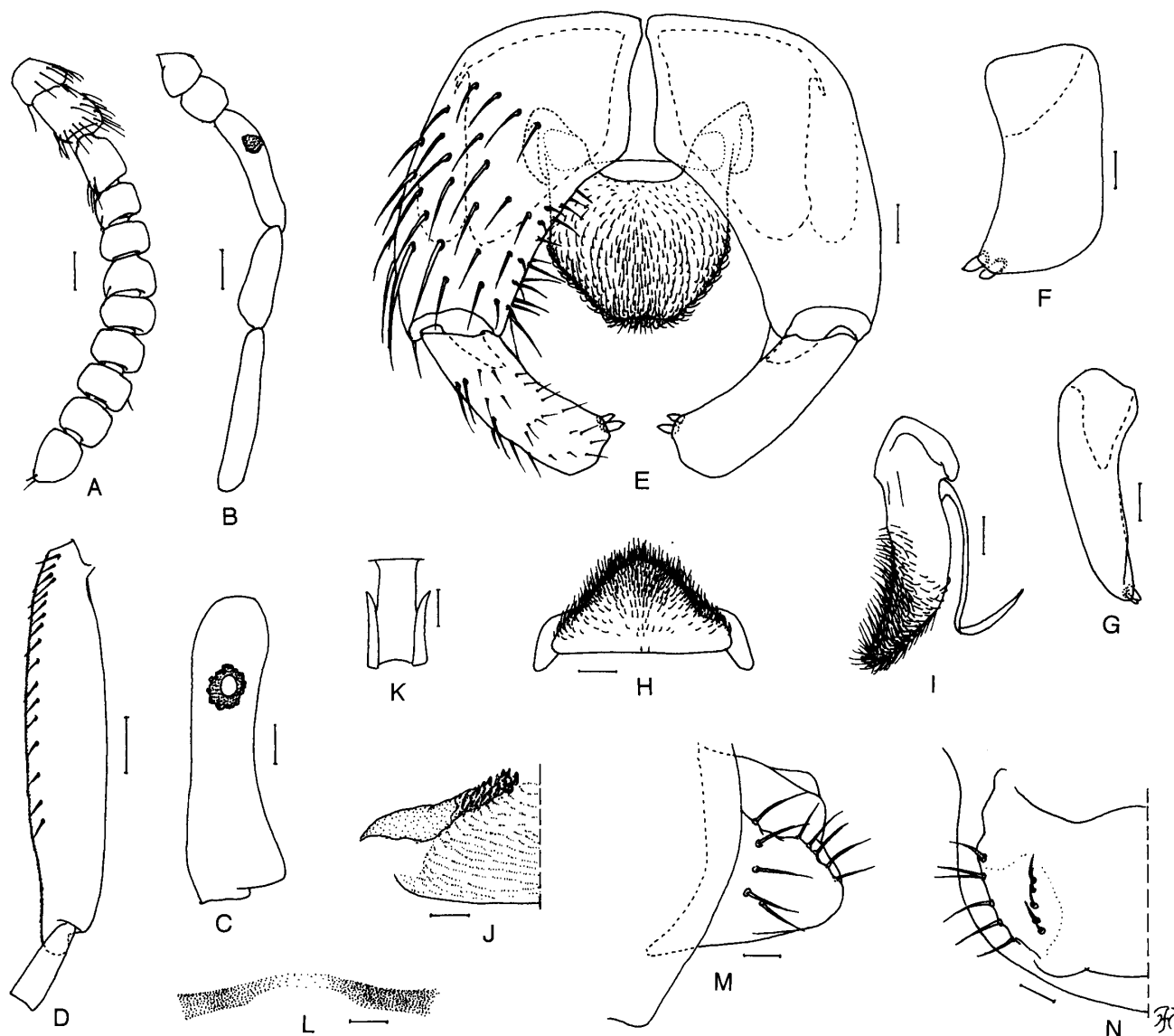


Fig. 2. Morphological characters of male of *Stegopterna trigonium*. A, antenna; B, maxillary palp (outer view); C, 3rd segment of maxillary palp (front view); D, basitarsus and 2nd tarsal segment of hind leg (outer view); E, coxites, styles and ventral plate *in situ* (ventral view); F, style (posterolateral view); G, style (ventrolateral view); H, ventral plate (end view); I, ventral plate and median sclerite (lateral view); J, paramere and aedeagal membrane (end view); K, median sclerite (dorsal view); L, dorsal plate; M and N, posterior tip of abdomen showing cercus (M, lateral view; N, end view). Scale bars. 0.1 mm for D; 0.05 mm for A and B; 0.02 mm for C and E-N.

covered with numerous stout hairs. Spermatheca globular (Fig. 1P) or somewhat ovoid (length less than 1.2 times maximal width) (Fig. 1Q), well sclerotized (except very small area of its juncture with duct unsclerotized), with indefinite reticulate surface pattern at least near base, with minute internal setae; both accessory ducts subequal in diameter to each other and somewhat larger than major one.

**Male.** Body length 3.5 mm. **Head.** Slightly narrower than thorax. Upper eye consisting of large facets in 25 horizontal rows and 25 verti-

cal columns (another pharate male with large facets in 24 horizontal rows and 23 vertical columns). Clypeus dark brown, sparsely covered with dark brown hairs. Antenna (Fig. 2A) composed of 2+9 segments, all dark brown; pedicel as long as and slightly wider than 1st flagellar segment, which is somewhat elongate, about 1.6 times as long as 2nd one; scape and pedicel covered with many medium-long dark hairs mainly on anterior surface, flagellar segment 1 with 4-6 similar but somewhat shorter dark hairs on posterodorsal surface, and some

of other flagellar segments also with 1 or 2 similar dark hairs; all flagellar segments densely covered with short setae as well as microsetae, as in female. Maxillary palp (Fig. 2B) composed of 5 segments, proportional lengths of 3rd, 4th, and 5th segments 1.0 : 0.8 : 1.3; 3rd segment (Fig. 2C) of normal size; sensory vesicle small (0.15 times as long as 3rd segment), globular, with medium-sized opening. **Thorax.** Scutum dark brown to brownish black, not shiny, densely covered with brassy recumbent short hairs interspersed with dark brown long upright hairs on prescutellar area. Scutellum dark brown, with numerous dark brown long upright hairs. Postnotum dark brown, and bare. Pleural membrane, katapisternum, and furcasternum as in female. **Legs.** All light to medium brown; fore basitarsus slender, cylindrical; hind tibial spurs long, each with hyaline apex as in female; hind basitarsus (Fig. 2D) somewhat swollen, slightly spindle-shaped, 4.85 times as long as wide, 0.84 and 0.78 times as wide as greatest widths of hind tibia and femur, respectively; calcipala short, slightly shorter than its basal width and 0.34 times as wide as greatest width of basitarsus; pedisulcus absent. **Wing.** As in female except  $R_1$  with medium brown hairs throughout its length and a few dark spinules near apex, and length 2.6 mm. **Abdomen.** Basal scale dark brown, with fringe of dark long hairs. Abdomen dark brown, not shiny, moderately covered with dark hairs. **Genitalia.** Coxite in ventral view (Fig. 2E) much longer than wide. Style (Fig. 2E) much shorter than coxite, broad, roughly subquadrate, truncate apically when viewed posterolaterally (Fig. 2F), but narrow, tapered toward apex when viewed ventrolaterally (Fig. 2G); style with 2 stout apical spines at dorsal corner. Ventral plate in ventral view (Fig. 2E) transverse, 0.8 times as wide as its length (from tip of arms to posterior tip of body), with lateral margins running nearly in parallel from base of arms to middle of body, then markedly converged toward posterior tip, and densely covered with fine colorless setae on ventral and posterior surfaces; ventral plate produced ventrally in form of a triangular lobe when viewed posteriorly (Fig. 2H) or an apically tapered lobe when viewed laterally (Fig. 2I); basal arms short and stout. Parameres (Fig. 2J) narrow, jagged apically, appearing to have many well sclerotized dark small spines. Median sclerite (Fig. 2K) broad, bifurcated apically. Aedeagal

membrane (Fig. 2J) densely covered with minute setae, and with weakly sclerotized narrow dorsal plate (Fig. 2L). Segment 10 without any distinct hair ventrally. Cercus (Fig. 2M, N) small, with 5 or 6 distinct hairs along posterior margin; 3 to 6 similar hairs laterally at base of cercus.

**Pupa.** Body length (excluding gill filaments) 3.6–4.2 mm. **Head.** Integument yellowish, densely covered with small tubercles of various shapes; some tubercles with minute nodule-like secondary projections on them; face with pair of long simple trichomes (Fig. 3A); frons without any trichomes. **Thorax.** Integument yellowish, densely covered with small tubercles of various sizes similar to those on head integument, and with 3 pairs of long stout simple trichomes dorsomedially (Fig. 3B), 2 pairs of long stout simple trichomes anterolaterally, and 1 pair of medium-long slender simple trichomes mediolaterally (Fig. 3C). Gill (Fig. 3D) with 12 slender filaments arranged in 3 groups of  $(2+2)+3+(3+2)$  filaments from dorsal to ventral (in 1 of 20 pupae, additional short filament arises from middle of lowest filament of middle triplet group of left gill); all 3 groups arising nearly at same level from short common basal stalk, dorsal group first directed upwards, then forwards, middle group first directed outwards, then forwards, and ventral group first directed forward or somewhat downwards, then forwards; stalks of dorsal and ventral groups nearly at right angle when viewed laterally; primary stalk of ventral group usually short while those of middle and dorsal groups medium-long; all filaments subequal in length (length from base to apical tip of longest filament 2.2–3.5 mm) and thickness to one another; all filaments gradually tapered toward tips, with annular ridges and furrows irregularly and partially, and densely covered with minute tubercles. **Abdomen.** All tergites and sternites yellowish, well defined, and widely separated by wrinkled thin pleural membrane (sternites 6 and 7 each further separated medially by wrinkled membrane into 2 parts). All tergites densely covered with microtubercles; tergite 1 with 1 or 2 simple slender short setae on each side; tergite 2 with a transverse row of 4 simple slender short setae on posterior 1/3, and 1 similar seta medially, on each side; tergites 3 and 4 each with 4 hooks (Fig. 3E) along posterior margin, and 2 simple slender short setae medially, on each side; ter-



Fig. 3. Morphological characters of pupa of *Stegopterna trigonium*. A, facial trichome; B and C, trichomes on thoracic integument (B, on dorsal surface; C, on mediolateral surface); D, gill filaments (outer view); E, hook on tergite 3; F, abdominal segment 9 (lateral view); G, hook on sternite 5; H, hooklets on lateral pleural membrane on abdominal segment 8. Scale bars. 0.2 mm for D; 0.02 mm for A-C and E-H.

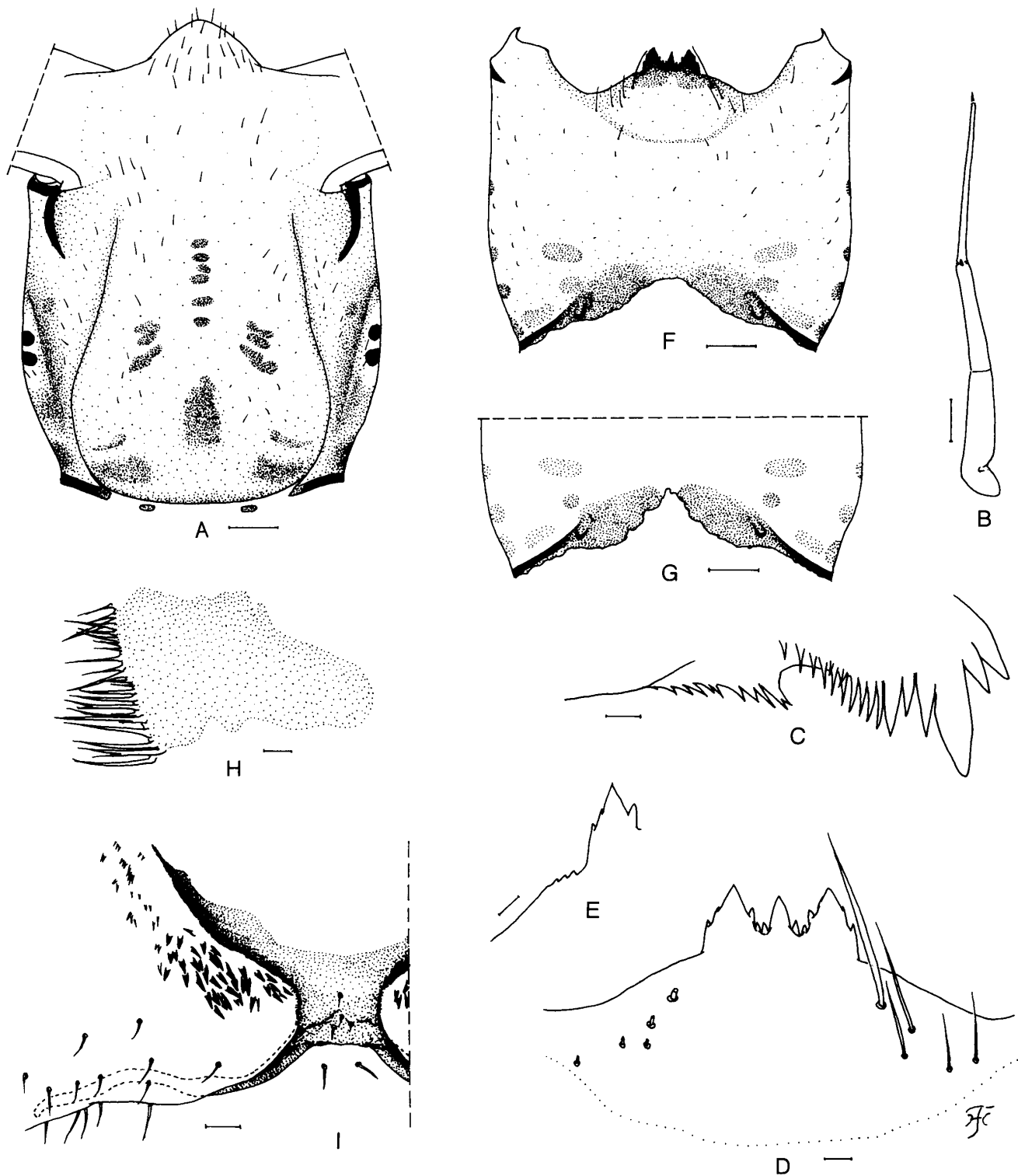


Fig. 4. Morphological characters of mature larva of *Stegopterna trigonium*. A, head capsule (dorsal view); B, antenna (inner view); C apical portion of mandible; D, hypostomium; E, lateral margin of hypostomium with serrated portion near apex; F, head capsule (ventral view) showing small round postgenal cleft; G, posterior portion of head capsule (ventral view) showing small triangular postgenal cleft; H, lateral plate of proleg; I, rectal scales along anterior arm of anal sclerite. Scale bars. 0.1 mm for A, F and G; 0.05 mm for B; 0.02 mm for D, E and I; 0.01 mm for C and H.

gites 5–9 each with transverse row of spine-combs along anterior margin (though those on tergite 5 a few in number or rarely absent), and tergites 5–8 each with 2–4 simple slender short setae medially and near posterior margin; tergite 9 (Fig. 3F) with pair of elongate apically-pointed terminal hooks, and, on each side, 2 branched hooklets (2–4 branches) situated near lateral margin (in some pupae, 1 of these 2 hooklets situated on lateral pleural membrane), and 1 simple or bifid long hooklet just posterior to each terminal hook. All sternites densely covered with microtubercles (except sternite 9 bare); sternites 3 and 4 with a few simple minute setae on each side; sternite 5 with pair of simple hooks (Fig. 3G) widely separated from each other near posterior margin on each side; sternites 6 and 7 each with 1 simple hook (similar in size to those on sternite 5) near posterior margin on each side. Segments 6 and 7 each with 1 simple hook (similar in size to those on sternite 5) on each lateral pleural membrane; segment 8 with 1 simple and 3 branched short hooklets on each lateral pleural membrane (Fig. 3H); segment 9 with 6 distinct hooklets (usually grapnel-shaped with 3–5 branches, but 1–4 hooklets sometimes simple) on each lateral pleural membrane (Fig. 3F). **Cocoon.** Shapeless, loosely woven, and covering posterior 1/2 to 3/4 of pupal body.

**Mature larva.** Body length 6.9–7.5 mm. Body color yellowish to light yellowish brown. Abdomen gradually widened from segment 3 or 4 toward segment 6, then narrowed toward posterior tip, when viewed dorsally. Cephalic apotome (Fig. 4A) yellow except large anterior portion whitish and narrow portion along posterior margin somewhat darkened; head spots distinctly positive except anterior spots of posterolateral ones rarely faintly defined; lateral and ventral surfaces yellow to dark yellow except eye-spot region whitish; eyebrow broadly darkened; 3 isolated spots and 2 large spots around eye-spot region, and those on both sides of postgenal cleft distinctly positive. Antenna (Fig. 4B) composed of 3 segments and apical sensillum, much longer than stem of labral fan; length ratio of segments (from base to tip) 1.0:0.9–1.0:1.1–1.6. Labral fan with 60–65 main rays. Mandible (Fig. 4C) with distinct comb-teeth, of which 1st and 3rd teeth subequal and much longer than 2nd one; major tooth of mandibular serrations simple or bifid, followed basally by numerous supernummary

serrations. Hypostomium (Fig. 4D) anteriorly with teeth arranged in 3 distinct groups; lateral margins nearly smooth to moderately serrated apically (Fig. 4E); 1 long and 2–4 medium-long hypostomal bristles diverging posteriorly from lateral border on each side. Postgenal cleft shallow, flat or rounded apically (Fig. 4F) in 10 larvae (in 1 larva, postgenal cleft is very shallow), or triangular with pointed apex (Fig. 4G) in 3 larvae. Thoracic cuticle almost bare. Proleg on each side with moderately sclerotized lateral plate much longer than width and narrowed on posterior 1/2 (Fig. 4H). Abdominal cuticle bare except last segment sparsely covered with short colorless setae on each side of anal sclerite. Rectal scales (Fig. 4I) consisting of usual colorless minute scales and dark stout spinous ones (most are simple, some bifid or trifid) near anterior arms of anal sclerite. Rectal organ of 3 simple lobes. Anal sclerite X-shaped, with anterior arms about 0.7 times as long as posterior ones; 3 or 4 sensilla on the basal juncture area, and 0–2 sensilla just posterior to posterior arms. Ventral papillae present. Posterior circlet with 62–66 rows of hooklets, with up to 12–15 hooklets per row.

**SPECIMENS EXAMINED.** 3 females, 1 male (all reared from pupae), 1 pharate male, 17 pupae, and 13 mature larvae, collected from a small slow-flowing stream, Hachirogahara, Shiobara City, Tochigi Prefecture, Japan, 7. V. 1985, by Dr. T. Matsumura.

**DISTRIBUTION.** Canada, Denmark, Finland, Japan (new record), Norway, Russia, Sweden, and U.S.A.

**REMARKS.** The present specimens almost agree morphologically with *St. trigonium*, redescribed and illustrated under the name of *St. richteri* (= *St. trigonium*) by Usova (1964). It should be noted that there is a difference in size of the female sensory vesicle between Russian and Japanese specimens: in the three females from Tochigi, Japan, the sensory vesicle is medium-sized, 0.32–0.35 times as long as the third maxillary palp, while in females from Russia it is apparently less than 0.25 times the length of the third segment, ac-



cording to the figure by Usova (1964), and the figures given by Rubtsov and Carlson (1965), and by Yankovsky (2002) under the names of *St. majalis* Rubtsov and Carlsson, *St. dentata* Rubtsov and Carlsson, *St. haematophaga* Rubtsov and Carlsson, and *St. longicoxa* Rubtsov (all were treated as synonyms of *St. trigonium* by Crosskey and Howard, 1997). Since *St. trigonium* is known to be widely distributed in the Holarctic Region (Crosskey and Howard, 1997; Adler et al., 2004) some quantitative features, such as the size of the sensory vesicle, may be subject to intraspecific variations.

In Hokkaido, northern Island of Japan, Ono (1977) described a new species, *St. nukabirana*, which has the 12 pupal gill filaments configured in the same fashion as those of *St. trigonium*. Ono (1977) mentioned that *St. nukabirana* is distinguished from *St. trigonium* by the genitalia of both sexes and mouthparts of the female (but did not mention what parts of the genitalia and mouthparts are different). Judging from the descriptions and figures of *St. nukabirana* given by Ono (1977), there seem to be several characters differing from those of *St. trigonium*: e.g., the ventral plate widened from base to middle, the female claw simple, without minute tooth, and the pupal gill filaments 1.2–1.4 mm long.

It is difficult to apply the name *St. trigonium* to all the specimens that were identified as *St. mutata* by Bentinck (1955) because females of *Stegopterna* collected while biting a human at three different localities in Honshu (Tochigi, Niigata, and Iwate Prefectures) proved that the spermathecae of almost all these females are ellipsoidal, with their length 1.2–1.4 times the maximum width, and also that there are great variations in the size of both sensory vesicle and frons among individual specimens even at the same locality. According to the figures given by Bentinck (1955), the sensory vesicle, mandible, maxilla, cibarium, and genitalia are almost the same as those of the females of *St.*

*trigonium* that emerged from the pupae collected from Tochigi except the shape of the spermatheca (i.e., ellipsoidal).

### *Stegopterna takeshii* sp. nov.

DESCRIPTION. **Female.** Unknown.

**Male.** Body length 3.5 mm. Nearly as in *St. trigonium* except following characters. **Head.** Upper eye consisting of large facets in 21 horizontal rows and 20 vertical columns. Antenna (Fig. 5A) with short dark hairs only on scape and pedicel. Maxillary palp (Fig. 5B) composed of 5 segments, proportional lengths of 3rd, 4th, and 5th segments 1.0:0.9:1.4; 3rd segment (Fig. 5C) of normal size; sensory vesicle medium-sized (0.26 times as long as 3rd segment), ellipsoidal, with medium-sized opening near apex. **Legs.** Not yet expanded. Fore basitarsus cylindrical. Hind basitarsus (Fig. 5D) appearing somewhat swollen, and with distinct calcipala; pedisulcus absent. **Wing.** Length not measurable. **Genitalia.** Somewhat smaller in size than that of *St. trigonium*. Ventral plate in ventral view (Fig. 5E) transverse, 1.2 times as wide as its length (from tip of arms to posterior tip of body), with lateral margins of its body very slightly converged from base of arms toward posterior 1/4 of body, with round posterior margin, and with short and slender arms directed forwards (though arms stout when viewed laterally); ventral plate in lateral view (Fig. 5F) rounded posteriorly (not tapered posteriorly), and only slightly produced ventrally. Cercus with 4 or 7 distinct hairs along posterior margin; 5 or 6 similar hairs laterally at base of cercus.

**Pupa.** Body length (excluding gill filaments) 3.5 mm. Nearly as in *St. trigonium* except following characters. **Head.** Trichomes on face appearing stouter than those of *St. trigonium*. **Thorax.** Gill (Fig. 5G) with 12 slender filaments arranged in 2 groups of  $[(2+2)+3]+[1+(2+2)]$  filaments from dorsal to ventral (1 of the 4 paired filaments of the dorsal group with a very short rod-like filament at its basal 1/4); common basal stalk short; primary stalk of dorsal group also short; primary stalk of ventral group short in left gill, while of moderate length in right gill which has an individual filament arising near base of 2 pairs of same group; all filaments subequal in length (length from base to apical tip of filaments 3.2–3.6 mm)

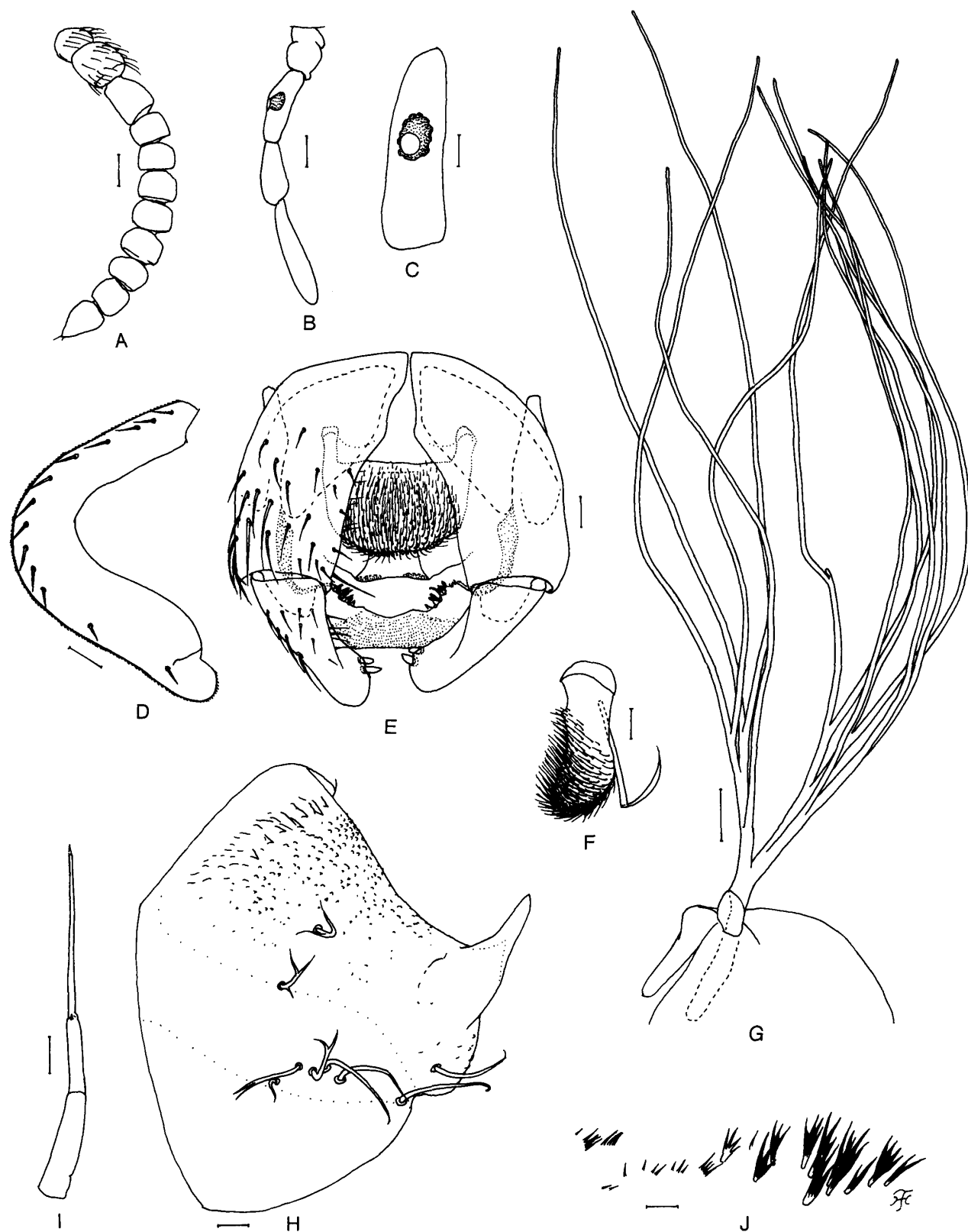


Fig. 5. Morphological characters of *Stegopterna takeshii* sp. nov. A-F, male; G and H, pupa; I and J, mature larva. A, antenna; B, maxillary palp (inner view); C, 3rd segment of maxillary palp (front view); D, basitarsus of hind leg (outer view); E, genitalia *in situ* (ventral view); F, ventral plate and median sclerite (lateral view); G, gill filaments (outer view); H, abdominal segment 9 (lateral view); I, antenna; J, rectal scales. Scale bars. 0.2 mm for G; 0.05 mm for A, B, D and I; 0.02 mm for C, E, F and H; 0.01 mm for J.

and thickness to one another. **Abdomen.** Tergite 9 with 2 simple, or bifid and trifold hooklets situated near lateral margin, and 1 simple long hooklet just posterior to each terminal hook (Fig. 5H) on each side, in addition to pair of elongated terminal hooks. Segment 8 with 4 simple, or 3 simple and 1 bifid short hooklets on each lateral pleural membrane; segment 9 with 4 simple and 2 bifid long hooklets on each lateral pleural membrane (Fig. 5H).

**Mature larva.** Body length 5.8 mm. Nearly as in *St. trigonium* except following characters. Antenna (Fig. 5I) composed of 3 segments and apical sensillum, much longer than stem of labral fan; length ratio of segments (from base to tip) 1.00:0.70:1.45. Labral fan with 56 main rays. Hypostomium with lateral margins weakly serrate apically. Postgenal cleft shallow, rounded apically, similar to Fig. 4F. Rectal scales multibranched, dark, stout, and spinous (Fig. 5J). Anal sclerite with 3 sensilla on basal juncture area, and 1 sensillum just posterior to posterior arms. Posterior circlet with 68 rows of hooklets, with up to 13 hooklets per row.

**TYPE SPECIMENS.** Holotype male (together with associated pupal exuvia), dissected out of a pupa, collected from a small slow-flowing stream, same data as *St. trigonium* except the date of collection: 26.IV.1982. Paratype: 1 mature larva, same data as holotype.

**DISTRIBUTION.** Japan (Tochigi Prefecture).

**ETYMOLOGY.** The species name *take-shii* is in honor of Dr. Takeshi Matsumura, who collected this new species.

**REMARKS.** This new species is distinguished from *St. trigonium* in the male by the fewer horizontal rows and vertical columns of large eyes, the third maxillary palpal segment with a medium-sized sensory vesicle (Fig. 5B), the ventral plate wider than its length (Fig. 5E), with its posterior portion not tapered posteriorly (Fig. 5F), in the pupa by the gill with 12 filaments arranged in two groups (Fig. 5G), and in the larva by the short second

segment of the antenna 0.7 times the length of the first segment (Fig. 5I), and larval rectal scales dark, stout, spinous, and multibranched (Fig. 5J).

This new species may be more closely related to five North American species of *Stegopterna*, *St. acra* Currie, Adler and Wood, *St. diplomutata* Currie and Hunter, *St. mutata*, *St. permutata* (Dyar and Shannon) and *St. xantha* Currie, Adler and Wood, by the similar arrangement of the pupal gill (Adler et al., 2004). This new species appears to be distinguished from all these known species by the short second segment of the larval antenna being 0.7 times as long as the first one (Fig. 5I). Judging from descriptions and figures given by Adler et al. (2004) there are other differences as follows: *St. mutata* is parthenogenic, without males; *St. acra* and *St. permutata* have a dark larval head capsule; *St. diplomutata* has a narrow calcpala about half as wide as the apex of the male basitarsus, and the pupal gill filaments arranged as [(2+2)+3]+(3+2) from above downwards.

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